PROTEIN NANOCAGE: A VERSATILE MOLECULAR CARRIER

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Protein nanocages can be engineered to tailor their functions as carriers for health (e.g. therapeutic and diagnostic agents), molecular electronic, and consumer care (e.g. cosmetics and food) applications. They are formed by the self-assembly of multiple subunits forming hollow cage-like structures of nanometer size. Due to their proteinaceous nature, the protein nanocages allow facile modifications on its internal and external surfaces, as well as the subunit interfaces designed for the intended applications. Protein nanocages loaded with metal have been shown to be promising MRI contrast agent or when loaded with drug, they can serve as drug carrier. Modifying the interface of the subunits render the nanocages sensitive to environmental changes, such as pH. Engineering of the external surface allows for the display of targeting ligands for selective accumulation on cancer cells as well as epitopes for modulating the immune system. Leveraging on its natural or engineered metal-chelating activities, protein nanocages serve a dual function as a reaction container and as facilitator in the deposition of monodispersed platinum nanoparticles on graphene surfaces for electrocatalysis in fuel cells. Long-range electron tunneling across metal-loaded protein nanocages has also been shown to be promising in the development of memristive devices and future molecular electronics. In the most recent works, we show that the protein nanocages are surface active with an ability to stabilize Pickering emulsion with pH-responsive behavior. Titrating the protein ratio allows for formation of gel-like structures. In summary, protein nanocages are versatile protein-based materials whose properties are tunable for various applications.

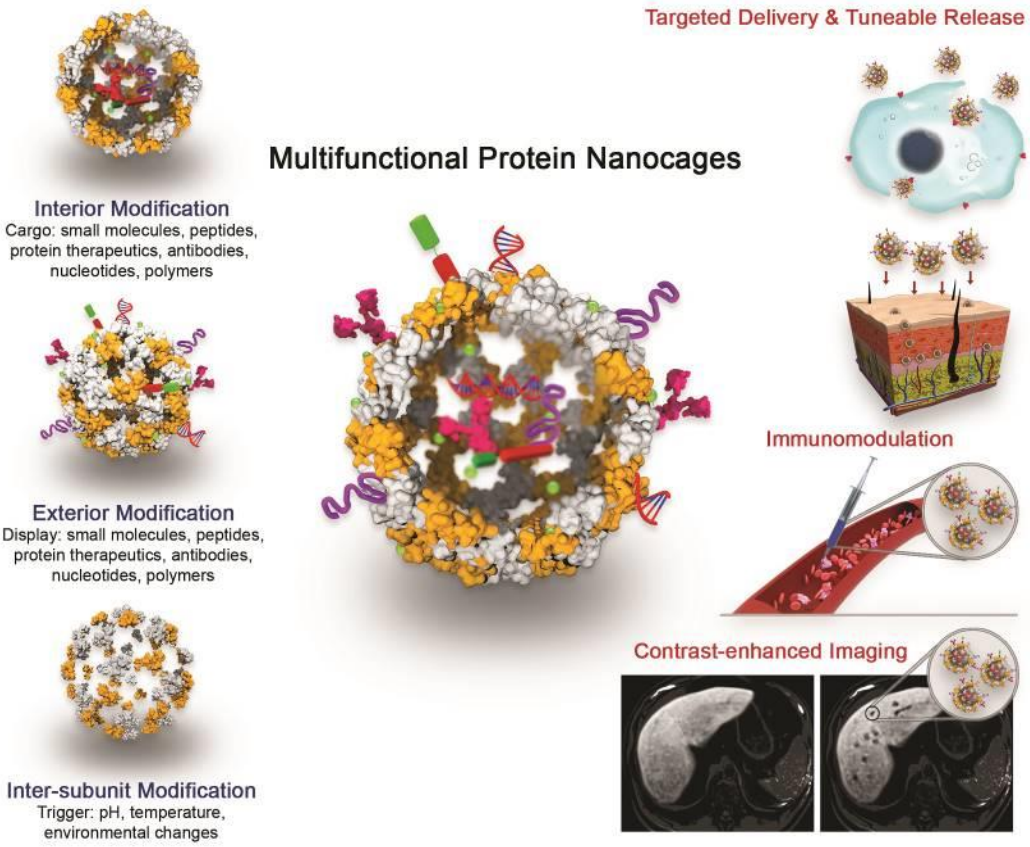

Figure 1 – Applications of protein nanocages in health and biomedicine.